Study Tip

Divide the class into four groups, and have the members of each group collaborate in writing study questions tied to one of the four sections in the chapter. The questions should cover all the Key Concepts and Vocabulary terms in the section. Each group should also produce an answer key. Then, provide each student with a list of the questions developed by all four groups. Students should answer the questions, and then check their answers against the answer keys.

Thinking Visually

Tables may vary, though all should include information from Section 2–3 about each of the four groups of biomolecules. A typical table might have these column heads: *Group, Structure, Properties, Functions,* and *Examples*. Students should complete their tables with as much information as possible from pages 45–48.

Chapter 2 Assessment

Reviewing Content

1. c **5.** b **8.** c
2. d **6.** d **9.** a
3. b **7.** c **10.** d
4. b

Understanding Concepts

11. Elements are composed of atoms. Compounds are composed of atoms of two or more elements combined in definite proportions.

12. Radioactive isotopes are isotopes whose nuclei are unstable and break down at a constant rate over time. Radioactive isotopes are used in determining the ages of rocks, treating cancer, killing bacteria in food, and following the movements of substances within organisms.

13. Atoms in a compound are held together by a chemical bond.

14. Two electrons are shared in a single covalent bond, four in a double bond, and six in a triple bond.

Chapter 2 Study Guide

2–1 The Nature of Matter

Key Concepts

- The subatomic particles that make up atoms are protons, neutrons, and electrons.
- Because they have the same number of electrons, all isotopes of an element have the same chemical properties.
- The main types of chemical bonds are covalent bonds and ionic bonds.

Vocabulary

atom, p. 35 • nucleus, p. 35 • electron, p. 35
element, p. 36 • isotope, p. 36
compound, p. 37 • ionic bond, p. 38
ion, p. 38 • covalent bond, p. 38
molecule, p. 38 • van der Waals forces, p. 39

2–2 Properties of Water

Key Concepts

- A water molecule is polar because there is an uneven distribution of electrons between the oxygen and hydrogen atoms.
- Acidic solutions contain higher concentrations of H^+ ions than pure water and have pH values below 7.
- Basic, or alkaline, solutions contain lower concentrations of H^+ ions than pure water and have pH values above 7.

Vocabulary

cohesion, p. 41 • adhesion, p. 41 • mixture, p. 41
solution, p. 42 • solute, p. 42 • solvent, p. 42
suspension, p. 42 • pH scale, p. 43 • acid, p. 43
base, p. 43 • buffer, p. 43

2–3 Carbon Compounds

Key Concepts

- Four groups of organic compounds found in living things are carbohydrates, lipids, nucleic acids, and proteins.
- Living things use carbohydrates as their main source of energy. Plants and some animals also use carbohydrates for structural purposes.
- Lipids can be used to store energy. Some lipids are important parts of biological membranes and waterproof coverings.
- Nucleic acids store and transmit hereditary, or genetic, information.
- Some proteins control the rate of reactions and regulate cell processes. Some proteins build tissues such as bone and muscle. Others transport materials or help to fight disease.

Vocabulary

monomer, p. 45 • polymer, p. 45
carbohydrate, p. 45 • monosaccharide, p. 46
polysaccharide, p. 46 • lipid, p. 46
nucleic acid, p. 47 • nucleotide, p. 47
ribonucleic acid (RNA), p. 47
deoxyribonucleic acid (DNA), p. 47
protein, p. 47 • amino acid, p. 47

2–4 Chemical Reactions and Enzymes

Key Concepts

- Chemical reactions always involve changes in the chemical bonds that join atoms in compounds.
- Chemical reactions that release energy often occur spontaneously. Chemical reactions that absorb energy will not occur without a source of energy.
- Enzymes speed up chemical reactions that take place in cells.

Vocabulary

chemical reaction, p. 49 • reactant, p. 49
product, p. 49 • activation energy, p. 50
catalyst, p. 51 • enzyme, p. 51 • substrate, p. 52

Thinking Visually

Create a table in which you compare the structures and functions of the following biomolecules: carbohydrates, lipids, proteins, and nucleic acids.

CHAPTER RESOURCES

Print:

- ***Teaching Resources,*** Chapter Vocabulary Review, Graphic Organizer
- ***Chapter Tests: Levels A and B,*** Chapter 2 Test
- ***Laboratory Assessment,*** Laboratory Assessment 1

Technology:

- ***Computer Test Bank,*** Chapter 2 Test
- ***iText,*** Chapter 2 Assessment

Chapter 2 Assessment

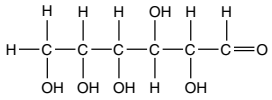
Interactive textbook with assessment at PHSchool.com

Reviewing Content

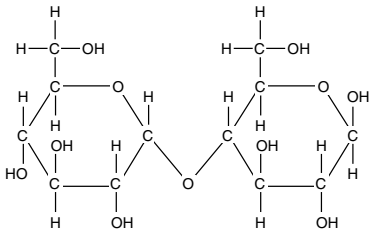
Choose the letter that best answers the question or completes the statement.

1. The positively charged particle in an atom is the
   a. neutron. **c.** proton.
   b. ion. **d.** electron.
2. Two or more different atoms are combined in definite proportions in any
   a. symbol. **c.** element.
   b. isotope. **d.** compound.
3. A covalent bond is formed by the
   a. transfer of electrons. **c.** gaining of electrons.
   b. sharing of electrons. **d.** losing of electrons.
4. When you shake sugar and sand together in a test tube, you cause them to form a
   a. compound. **c.** solution.
   b. mixture. **d.** suspension.
5. A compound that produces hydrogen ions in solution is a(an)
   a. salt. **c.** base.
   b. acid. **d.** polymer.
6. In polymerization, complex molecules are formed by the joining together of
   a. macromolecules. **c.** polymers.
   b. carbohydrates. **d.** monomers.
7. Which formula represents an amino acid?

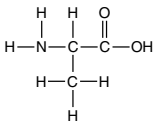
a.



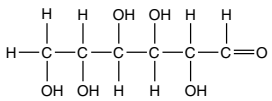
b.



c.



d.



8. Proteins are polymers formed from
   a. lipids.
   b. carbohydrates.
   c. amino acids.
   d. nucleic acids.
9. An enzyme speeds up a reaction by
   a. lowering the activation energy.
   b. raising the activation energy.
   c. releasing energy.
   d. absorbing energy.
10. In a chemical reaction, a reactant binds to an enzyme at a region known as the
    a. catalyst.
    b. product.
    c. substrate.
    d. active site.

Understanding Concepts

11. Explain the relationship among atoms, elements, and compounds.
12. What is a radioactive isotope? Describe two scientific uses of radioactive isotopes.
13. How are atoms in a compound held together?
14. Distinguish among single, double, and triple covalent bonds.
15. Explain the properties of cohesion and adhesion. Give an example of each property.
16. What is the relationship among solutions, solutes, and solvents?
17. How are acids and bases different? How do their pH values differ?
18. Explain the relationship between monomers and polymers, using polysaccharides as an example.
19. Identify three major roles of proteins.
20. Describe the parts of a nucleotide.
21. Name the two basic kinds of nucleic acids. What sugar does each contain?
22. What is a chemical reaction?
23. Describe the two types of energy changes that can occur in a chemical reaction.
24. What relationship exists between an enzyme and a catalyst?
25. Describe some factors that may influence enzyme activity.

HOMEWORK GUIDE

Section:	Questions:
Section 2–1	1–3, 11–14, 32, 37
Section 2–2	4, 5, 15–17, 26, 35, 38
Section 2–3	6–8, 18–21, 29–31, 34
Section 2–4	9, 10, 22–25, 27, 28, 33, 36

If your class subscribes to the iText, your students can go online to access an interactive version of the Student Edition and a self-test.

(Continued from page 56)

15. Cohesion is an attraction between molecules of the same substance. An example is drops of water forming beads on a smooth surface. Adhesion is an attraction between molecules of different substances. An example is capillary action.

16. A solution is a mixture in which one substance is dissolved in another. The solute is the substance that is dissolved. The solvent is the substance in which the solute is dissolved.

17. An acid is any compound that produces H^+ ions in solution; acidic solutions have pH values below 7. A base is a compound that produces hydroxide ions (OH^-) in solution; basic solutions have pH values above 7.

18. Polymers are large macromolecules made up of smaller molecules called monomers. For example, monomers called monosaccharides are joined together to form polymers called polysaccharides.

19. Proteins control the rate of chemical reactions, regulate cell processes, form tissues, transport substances, and help fight disease.

20. Nucleotides consist of a 5-carbon sugar, a phosphate group, and a nitrogenous base.

21. The two basic kinds are ribonucleic acid (RNA), which contains the sugar ribose, and deoxyribonucleic acid (DNA), which contains the sugar deoxyribose.

22. A chemical reaction is a process that changes one set of chemicals into another set of chemicals.

23. Some chemical reactions release energy, and others absorb energy.

24. An enzyme is a biological catalyst.

25. Factors that can influence enzyme activity include pH, temperature, and proteins in cells that help turn key enzymes "on" and "off" at critical stages.

Critical Thinking

26. Adding a base to the solution would increase its pH, because a base produces hydroxide ions in solution and basic solutions have pH values above 7.

27. To carry out all life processes, living things need the energy released in the chemical reactions involved in digesting food.

28. The total product was doubled when the temperature of the reaction increased from 25°C to 35°C, and it decreased to almost zero when the temperature was increased to 45°C. Enzymes work best at certain temperatures. Students should hypothesize that the enzyme involved in this reaction works best at about 35°C, and a much higher temperature inhibits the enzyme's function.

29. Students might suggest trying to dissolve the solid in water. Lipids are generally not water soluble. They also might suggest warming the solid to see if it would soften, which solid lipids tend to do when heated.

30. The mixture could be separated by adding water. The sodium chloride would dissolve in the water, whereas the silica would not. The salt could be retrieved by filtering the mixture and evaporating the filtrate.

31. The name indicates that carbohydrates contain carbon and the elements in water, oxygen and hydrogen.

32. The diagram should show that hydrogen and chlorine form a covalent bond. Students can use the chlorine atom in Figure 2–3 as a starting point and pair up one of the seven electrons in its outer level with hydrogen's single electron.

33. If the temperature or pH were changed, the shape of the enzyme hexokinase could change. It might lose its ability to bind with the substrates, glucose and ATP, and an enzyme-substrate complex would not form. As a result, the enzyme would not speed up the reaction.

34. Students might refer to the structural formulas for glucose, on page 45, and for an amino acid, on page 47, and then use a reference book for illustrations of three-dimensional models of these substances.

35. Students should infer that magnesium hydroxide is a base. The base reacts with the acid in the stomach, and forms a product that is not acidic.

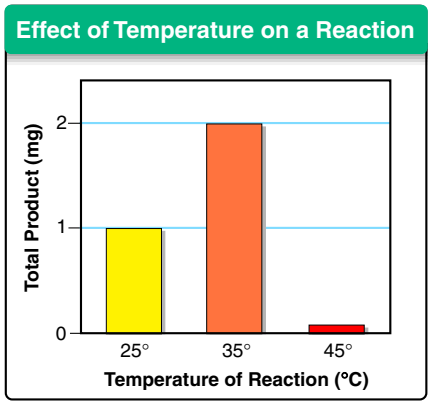
Chapter 2 Assessment

Critical Thinking

26. Predicting Suppose you wanted to increase the pH of a solution. What could you add to the solution to increase the pH? Explain your prediction.

27. Inferring Why is it important that energy-releasing reactions take place in living organisms?

28. Interpreting Graphics The bar graph shows the total amount of product from a chemical reaction performed at three different temperatures. The same enzyme was involved in each case. Describe the results of each reaction. How can you explain these results?



29. Designing Experiments Suggest one or two simple experiments to determine whether a solid white substance is a lipid or a carbohydrate. What evidence would you need to support each hypothesis?

30. Problem Solving Silica is a hard, glassy material that does not dissolve in water. Suppose sodium chloride is accidentally mixed with silica. Describe a way to remove the sodium chloride.

31. Inferring Explain what the name "carbohydrate" might indicate about the chemical composition of sugars.

32. Using Models Make a diagram like the one in **Figure 2–4** to show how chlorine and hydrogen form from the compound hydrogen chloride, HCl.

33. Predicting Changing the temperature or pH can change an enzyme's shape. Describe how changing the temperature or pH might affect the function of the enzyme in **Figure 2–21.**

34. Making Models Make three-dimensional models of organic compounds such as single sugars and amino acids. Refer to illustrations in this textbook or in other reference books.

35. Predicting As part of the digestive process, the human stomach produces hydrochloric acid, HCl. Sometimes excess acid causes discomfort. In such a case, a person might take an antacid such as magnesium hydroxide, $Mg(OH)_2$. Explain how this substance can reduce the amount of acid in the stomach.

36. Using Analogies Explain why a lock and key are used to describe the way an enzyme works. Describe any ways in which the analogy is not perfect.

37. Applying Concepts Using two or three examples, describe how a forensic scientist might use the knowledge of biology in his or her daily work.

38. Connecting Concepts Refer back to Chapter 1 to review the way scientists work. Then, describe an experiment that would test the effects of pH on a plant species.

Writing in Science

Write a paragraph that includes the following: (a) a brief explanation of a polymer, (b) a description of the four major classes of organic compounds found in living things, and (c) a description of how these organic compounds are used by the human body. (*Hint*: Review each of the Key Concepts in Section 2–3.)

Performance-Based Assessment

Creative Writing At a yearly convention, individual atoms describe their recent experiences. Assume you are an oxygen atom that began the year in an O_2 molecule, then spent time in a water molecule, in a hydroxide ion, and in carbonic acid. Write a speech describing the chemical reactions you experienced and the other molecules you met along the way.

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36. The fit of an enzyme and a substrate at the enzyme's active site is so precise that the substrate is like a key and the enzyme is like a lock. Like a key in a lock, only a substrate of a certain shape can fit into the active site of the enzyme. What occurs when a key is inserted into a lock is a physical process, unlike what occurs at an active site, which is a chemical process.

37. Answers will vary. A typical response might describe examples of a forensic scientist using knowledge about blood, human tissues, or animal life cycles to solve criminal cases.

38. All responses should reflect an understanding of how scientists design an experiment using this procedure: stating the problem, forming a hypothesis, setting up a controlled experiment, recording and analyzing results, and drawing a conclusion. A typical experiment might involve observing differences in several plants' growth, with the pH of the soil being the manipulated variable.